CLAIMS

1. A bonding method which comprises performing anodic bonding of objects to be bonded after subjecting bonding surfaces of both the objects to be bonded to a surface activation treatment using an energy wave, such as an atom beam, an ion beam, or a plasma.

2. The bonding method according to claim 1, wherein both the objects to be bonded are heated at less than 400°C during or after bonding.

3. The bonding method according to claim 1 or 2, wherein, after said surface activation treatment, the anodic bonding of both the objects to be bonded is performed without exposure to the atmospheric air.

4. The bonding method according to claim 3, wherein said energy wave is a low-pressure plasma, and continuously after said surface activation treatment, the objects to be bonded are contacted with each other in a vacuum in the same chamber to perform the anodic bonding.

5. The bonding method according to any of claims 1 to 4, wherein an amount of etching using said energy wave is 1 nm or more.

6. The bonding method according to claim 1 or 2, wherein, after performing preliminary bonding due to surface activation at room

temperature, main bonding due to the anodic bonding is performed in a separate step or device.

7. The bonding method according to claim 6, wherein a single of said preliminary bonding step is balanced with a plurality of said main bonding steps.

8. The bonding method according to claim 6 or 7, wherein three or more objects to be bonded are stacked and bonded together, and objects to be bonded having the same coefficient of linear expansion sandwich an object to be bonded having a different coefficient of linear expansion from both sides thereof.

9. The bonding method according to any of claims 6 to 8, wherein said preliminary bonding is performed in a low-pressure chamber under a low pressure or in a replacing gas, and said main bonding is performed in the atmospheric air.

10. The bonding method according to any of claims 6 to 9, wherein said energy wave is a plasma.

11. The bonding method according to claim 10, wherein said plasma is a low-pressure plasma, and continuously after said surface activation treatment, the objects to be bonded are contacted with each other in a

vacuum in the same chamber to perform said preliminary bonding.

12. The bonding method according to claim 10 or 11, wherein the bonding surfaces are subjected to a hydrophilic treatment using said plasma to perform said preliminary bonding.

13. The bonding method according to claim 12, wherein, during or after said hydrophilic treatment using said plasma, said preliminary bonding is performed after introducing and mixing a gas containing H_2O or H and OH groups.

14. The bonding method according to claim 12 or 13, wherein, in said hydrophilic treatment using said plasma, a physical treatment using an increased ion strike force is performed and thereafter, without exposure to the atmospheric air, a chemical treatment using a reduced ion strike force is performed.

15. The bonding method according to claim 14, wherein said physical treatment is performed using an Ar or CF_4 plasma.

16. The bonding method according to claim 14, wherein said chemical treatment is performed using an oxygen or nitrogen plasma.

17. The bonding method according to any of claims 1 to 16, wherein at

least one of the objects to be bonded is made of Si or an oxide including glass, SiO_2 and ceramics.

18. A device, such as a semiconductor device, a MEMS device or the like, which is produced using the bonding method according to any of claims 1 to 17 and in which the object to be bonded is a wafer or a chip cut off from the wafer.

19. A bonding device comprising an anodic bonding means for performing anodic bonding of objects to be bonded after subjecting bonding surfaces of both the objects to be bonded to a surface activation treatment using an energy wave, such as an atom beam, an ion beam, or a plasma, and the anodic bonding means has a voltage applying means and a heating means.

20. The bonding device according to claim 19, wherein both the objects to be bonded are heated at less than 400°C during or after bonding.

21. The bonding device according to claim 19 or 20, wherein an energy wave treatment means and said anodic bonding means are provided in a low-pressure chamber, and after said surface activation treatment, the anodic bonding of both the objects to be bonded is performed without exposure to the atmospheric air.

22. The bonding device according to claim 21, wherein said energy wave is a low-pressure plasma, a plasma treatment means and said anodic bonding means are provided in the same low-pressure chamber, and continuously after said surface activation treatment, the objects to be bonded are contacted with each other in a vacuum in said same chamber to perform the anodic bonding.

23. The bonding device according to any of claims 19 to 22, wherein an amount of etching using said energy wave is 1 nm or more.

24. The bonding device according to claim 19 or 20, wherein the device comprises an activating means for performing surface activation using said energy wave, and after performing preliminary bonding due to surface activation at room temperature, main bonding due to the anodic bonding is performed in a separate step or device.

25. The bonding device according to claim 24, wherein a single step or device of performing said preliminary bonding is balanced with a plurality of steps or devices of performing said main bonding.

26. The bonding device according to claim 24 or 25, wherein three or more objects to be bonded are stacked and anodic-bonded together, and objects to be bonded having the same coefficient of linear expansion sandwich an object to be bonded having a different coefficient of linear

expansion from both sides thereof, and the device comprises a means for simultaneously applying a voltage from the middle member toward the members at both ends.

27. The bonding device according to any of claims 24 to 26, wherein the device comprises a low-pressure chamber, and said preliminary bonding is performed in said low-pressure chamber under a low pressure or in a replacing gas, and said main bonding is performed in the atmospheric air.

28. The bonding device according to any of claims 24 to 27, wherein said energy wave is a plasma, and the device comprises a plasma treatment means.

29. The bonding device according to claim 28, wherein said plasma is a low-pressure plasma, the device comprises a vacuum chamber capable of providing a low pressure, a plasma generating means and a plasma reaction gas supplying means, and continuously after said surface activation treatment, the objects to be bonded are contacted with each other in a vacuum in said same chamber to perform said preliminary bonding.

30. The bonding device according to claim 28 or 29, wherein the bonding surfaces are subjected to a hydrophilic treatment using said plasma to perform said preliminary bonding.

31. The bonding device according to claim 30, wherein the device comprises a water gas generating means, and during or after said hydrophilic treatment using said plasma, said preliminary bonding is performed after introducing and mixing a gas containing H_2O or H and OH groups.

32. The bonding device according to claim 30 or 31, wherein the device comprises a low-pressure plasma treatment means for changing an ion strike force with respect to the objects to be bonded, and in said hydrophilic treatment using said plasma, a physical treatment using an increased ion strike force is performed and thereafter, without exposure to the atmospheric air, a chemical treatment using a reduced ion strike force is performed.

33. The bonding device according to claim 32, wherein said physical treatment is performed using an Ar or CF_4 plasma.

34. The bonding device according to claim 32, wherein said chemical treatment is performed using an oxygen or nitrogen plasma.

35. The bonding device according to any of claims 19 to 34, wherein at least one of the objects to be bonded is made of Si or an oxide including glass, SiO_2 and ceramics.